

**HIWIN® MIKROSYSTEM**



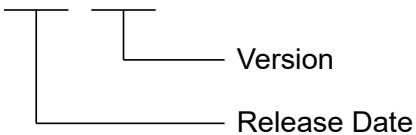
# Application Note

E Series MECHATROLINK-III Drive Complete Setup  
with SYNTEC CNC Controller

# Revision History

The version of the manual is also indicated on the bottom of the front cover.

MD51UE01-2506\_V1.0



Release Date	Version	Applicable Product	Revision Contents
Jun. 6 <sup>th</sup> , 2025	1.0	E Series MECHATROLINK-III Drive	First edition.

## Related Documents

Through related documents, users can quickly understand the positioning of this manual and the correlation between manuals and products. Go to HIWIN MIKROSYSTEM's official website → Download → Manual Overview for details ([https://www.hiwinmikro.tw/Downloads/ManualOverview\\_EN.htm](https://www.hiwinmikro.tw/Downloads/ManualOverview_EN.htm)).

## Preface

This manual explains the operation of controller's built-in human machine interface when E series MECHATROLINK-III drive is used with SYNTEC CNC controller. The contents in this manual, including communication setup for controller, parameters setup, test run, are arranged in accordance with the procedure of complete machine setup. For further understanding of E series MECHATROLINK-III drive, please refer to "E Series Servo Drive MECHATROLINK-III Communication Command Manual."

Note: SYNTEC is the registered trademark of SYNTEC TECHNOLOGY CO., LTD.

## Specifications of Software/Hardware

Name	Version of Software/Firmware
E Series MECHATROLINK-III Drive	Software (Thunder): 1.13.7.0 or above Firmware: 2.13.6 or above (E1) / 3.13.6 or above (E2)
SYNTEC CNC Controller	Software: eHMC_10.117.45 or above

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# 1. Communication Setup

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## 1.1 Communication specification

Table 1.1.1

MECHATROLINK-III Communication Specification	
Station Address Setup	03 ~ EF hex
Baud Rate	100 Mbps
Transmission Cycle	250 µs, 500 µs, 750 µs, 1.0 ms to 4.0 ms (0.5 ms increment)
Transmission Bytes	32 Bytes or 48 Bytes
Control Method	Position control, Velocity control, Torque control
Profile	Standard servo profile

## 1.2 Connect to E series servo drive (CN9)

Use Ethernet crossover cable to connect servo drive to MECHATROLINK-III compatible master or device.  
For the pin assignment of the crossover cable, please refer to Figure 1.2.1.

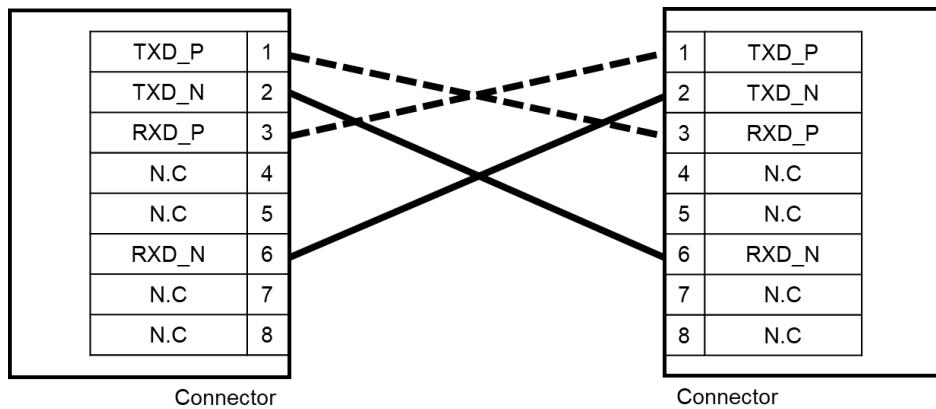


Figure 1.2.1

## 1.3 MECHATROLINK-III communication setup

### 1.3.1 Panel configuration for ED1F drive

The rotary switches (SW1 and SW2) and DIP switch (SW3) shown in Figure 1.3.1.1 are used to set MECHATROLINK-III communication station number and transmission Bytes.

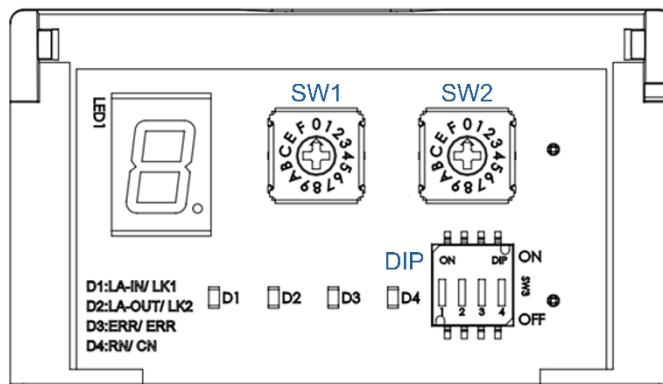


Figure 1.3.1.1

#### ■ Setting of transmission Bytes (SW3)

Set transmission Bytes via DIP switch (SW3). If the setting is wrong, normal communication cannot be performed. While connecting to SYNTEC CNC controller, it is usually 48 Bytes.

Table 1.3.1.1

SW3	Function	Setting		
		1	2	Transmission Bytes
Pin 1 and 2	Set transmission Bytes	OFF	OFF	Reserved
		ON	OFF	32 Bytes
		OFF	ON	48 Bytes
		ON	ON	Reserved
Pin 3	Reserved			
Pin 4	Reserved			

**■ Station address (SW1 and SW2)**

Set station number by using the rotary switches (SW1 and SW2). While connecting two or more MECHATROLINK-III compatible products, please set different station number for each product.

Table 1.3.1.2

SW1	SW2	Station Address
0	0 to 2	Reserved
0	3	03h
:	:	:
E	F	EFh
F	0 to F	Reserved

Note:

If the settings of the communication switches (SW1, SW2, and SW3) are changed, please reset power for the new settings to take effect. The station number of SYNTEC CNC controller starts from 0x21.

### 1.3.2 Panel configuration for ED2F drive

The rotary switches (SW1 and SW2) shown in Figure 1.3.2.1 are used to set MECHATROLINK-III communication station number. For transmission Bytes, set it via Thunder software.

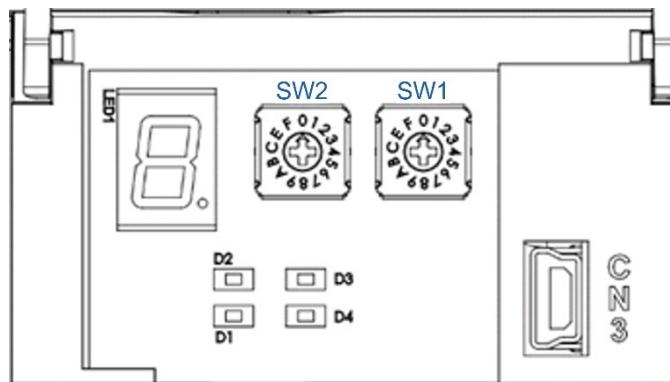


Figure 1.3.2.1

#### ■ Transmission Bytes

The default setting of transmission Bytes is 48 Bytes. If there is a need to change it, set it via Thunder software.

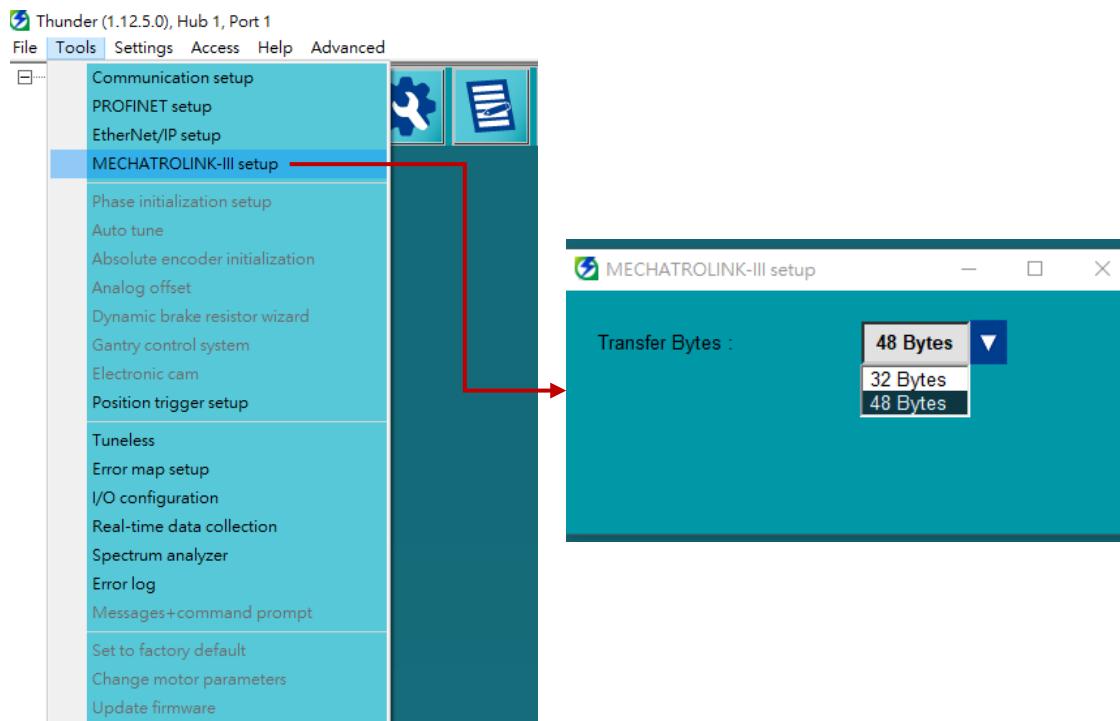


Figure 1.3.2.2

**■ Station address (SW1 and SW2)**

Set station number by using the rotary switches (SW1 and SW2). While connecting two or more MECHATROLINK-III compatible products, please set different station number for each product.

Table 1.3.2.1

SW1	SW2	Station Address
0	0 to 2	Reserved
0	3	03h
:	:	:
E	F	EFh
F	0 to F	Reserved

Note:

If the settings of the communication switches (SW1 and SW2) are changed, please reset power for the new settings to take effect. The station number of SYNTEC CNC controller starts from 0x21.

### 1.3.3 SYNTEC CNC controller's motion control card setting

After confirming that the settings of the rotary switches (SW1 and SW2) and DIP switch (SW3) are correct, set the motion control card via controller's human machine interface, **path: Home → Electronic Control Module → Parameter Setup**. If the controller is connected to a single axis, set number 21 to 1; if two axes are connected, set numbers 21 and 22 to 1 and 2 respectively (as Table 1.3.3.1 shows), and so on.

Table 1.3.3.1

Number	Description	Value
21	Motion control card port number corresponding to X axis	1
22	Motion control card port number corresponding to Y axis	2

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## 2. Parameters Setup

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## 2.1 Parameters writing / saving

After confirming that the controller and the servo drive are connected, set servo drive Pt parameters via controller's Pn parameters setup interface (**path: Home → Electronic Control Module → Parameter Setup → Serial Parameters**). For example, setting Pn100 = 500 indicates setting servo drive Pt100 = 500. Before entering the setting page of Serial Parameters, press the red "Emergency Stop" button on the control panel to ensure that the servo drive is not at servo ready state during the setting process.

After setting Pn parameters, save the parameters by setting Pn81F to 1 (as Table 2.1.1 shows). This can prevent the parameters from returning to the default values after the power of servo drive is reset.

Table 2.1.1

Parameter	Description	Value
Pn81F	Command data allocation	0001

Note:

When saving the parameters, it is normal for the servo drive to pop up the disconnection alarm AL.FB1.

It is recommended to adjust all the required parameters before saving them.

## 2.2 Parameters setup

### 2.2.1 Parameters for setting basic function – Pn0□□

Table 2.2.1.1

Parameter	Parameter name	Can be set on controller's human machine interface	Remark
Pn000	Function selection application switch 0	X	Set them via Thunder.
Pn001	Function selection application switch 1	X	
Pn002	Function selection application switch 2	X	
Pn006	Function selection application switch 6	X	
Pn007	Function selection application switch 7	X	
Pn008	Function selection application switch 8	X	
Pn009	Function selection application switch 9	X	
Pn00A	Function selection application switch A	X	
Pn00B	Function selection application switch B	X	
Pn00C	Function selection application switch C	X	
Pn00D	Function selection application switch D	X	

## 2.2.2 Parameters for tuning – Pn1□□

Table 2.2.2.1

Parameter	Parameter name	Can be set on controller's human machine interface	Remark
Pn100	Velocity loop gain	O	
Pn101	Velocity loop integral time constant	O	
Pn102	Position loop gain	O	If the setting of Pt102 is greater than 20000, set it via Thunder.
Pn103	Moment of inertia ratio	O	If the setting of Pt103 is greater than 20000, set it via Thunder.
Pn104	Second velocity loop gain	O	
Pn105	Second velocity loop integral time constant	O	
Pn106	Second position loop gain	O	If the setting of Pt106 is greater than 20000, set it via Thunder.
Pn109	Feedforward	O	
Pn10A	Feedforward filter time constant	O	
Pn10B	Gain application switch	X	Set Pt10B via Thunder.
Pn10C	Mode switch (Torque command)	O	
Pn10D	Mode switch (Velocity command)	O	
Pn10E	Mode switch (Acceleration)	O	
Pn10F	Mode switch (Position deviation)	O	
Pn11F	Position integral time constant	O	
Pn121	Friction compensation gain	O	
Pn122	Second friction compensation gain	O	
Pn123	Friction compensation coefficient	X	Not supported.
Pn124	Friction compensation frequency correction	X	
Pn125	Friction compensation gain correction	X	
Pn131	Gain switching time 1	O	
Pn132	Gain switching time 2	O	
Pn135	Gain switching waiting time 1	O	
Pn136	Gain switching waiting time 2	O	
Pn139	Automatic gain switching selection 1	O	
Pn13D	Current gain level	O	
Pn140	Model following control selection	O	Pt140 only supports model following control and vibration suppression.
Pn141	Model following control gain	O	

Parameter	Parameter name	Can be set on controller's human machine interface	Remark
Pn142	Model following control gain compensation	O	
Pn143	Model following control bias in forward direction	O	
Pn144	Model following control bias in reverse direction	O	
Pn145	Vibration suppression 1 frequency A	X	
Pn146	Vibration suppression 1 frequency B	X	Not supported.
Pn147	Model following control velocity feedforward compensation	O	
Pn148	Second model following control gain	O	
Pn149	Second model following control gain compensation	O	
Pn14A	Vibration suppression 2 frequency	O	Corresponding to Pt14A, it is vibration suppression 1 frequency.
Pn14B	Vibration suppression 2 compensation	O	Corresponding to Pt14B, it is vibration suppression 1 compensation.
Pn160	Anti-resonance control selection	X	
Pn161	A type anti-resonance frequency	X	
Pn162	A type anti-resonance gain compensation	X	
Pn163	A type anti-resonance damping gain	X	
Pn164	A type anti-resonance filter time constant 1 compensation	X	
Pn165	A type anti-resonance filter time constant 2 compensation	X	
Pn166	A type anti-resonance damping gain 2	X	
Pn170	Tuning Less selection	X	Set Pt170 via Thunder.
Pn181	Mode switch (Linear motor velocity command)	O	
Pn182	Mode switch (Linear motor acceleration)	O	

**2.2.3 Position-related parameters – Pn2□□**

Table 2.2.3.1

Parameter	Parameter name	Can be set on controller's human machine interface	Remark
Pn205	Multi-turn limit	O	
Pn207	Position control function selection	O	
Pn20A	Number of external encoder scale pitches	O	
Pn20E	Electronic gear ratio (Numerator)	O	
Pn210	Electronic gear ratio (Denominator)	O	
Pn212	Number of encoder output pulses	O	
Pn22A	Full-closed loop control selection	O	
Pn230	Position control expansion function selection	X	Not supported.
Pn231	Backlash compensation	X	
Pn233	Backlash compensation time constant	X	
Pn281	Encoder output resolution	X	Set Pt281 via Thunder.
Pn282	Number of linear encoder scale pitches	X	Not supported.

## 2.2.4 Velocity-related parameters—Pn3□□

Table 2.2.4.1

Parameter	Parameter name	Can be set on controller's human machine interface	Remark
Pn304	JOG velocity	O	
Pn305	Soft start acceleration time	O	<ul style="list-style-type: none"> <li>Range of Pn305: 0~10000</li> <li>Range of Pt305: 0~65535</li> </ul>
Pn306	Soft start deceleration time	O	<ul style="list-style-type: none"> <li>Range of Pn306: 0~10000</li> <li>Range of Pt306: 0~65535</li> </ul>
Pn308	Velocity feedback filter time constant	O	
Pn30A	Deceleration time for servo OFF and forced stop	O	<ul style="list-style-type: none"> <li>Range of Pn30A: 0~10000</li> <li>Range of Pt30A: 0~65535</li> </ul>
Pn30C	Velocity feedforward average movement time	O	Pt30C only supports 0~500, with the unit of 0.25 ms.
Pn310	Vibration detection selection	X	Not supported.
Pn311	Vibration detection sensitivity	X	
Pn312	Vibration detection level	X	
Pn316	Maximum motor velocity	O	
Pn324	Moment of inertia calculation starting level	X	Not supported.
Pn383	JOG velocity (Linear)	O	
Pn385	Maximum motor velocity (Linear)	O	

**2.2.5 Torque-related parameters – Pn4□□**

Table 2.2.5.1

Parameter	Parameter name	Can be set on controller's human machine interface	Remark
Pn401	First stage first torque command filter time constant	O	
Pn402	Forward torque limit	O	
Pn403	Reverse torque limit	O	
Pn404	Forward external torque limit	O	
Pn405	Reverse external torque limit	O	
Pn406	Emergency stop torque	O	
Pn407	Velocity limit during torque control	O	
Pn408	Torque-related function selection	O	Pt408 does not support velocity control selection.
Pn409	First stage notch filter frequency	O	
Pn40A	First stage notch filter Q value	O	
Pn40B	First stage notch filter depth	O	
Pn40C	Second stage notch filter frequency	O	
Pn40D	Second stage notch filter Q value	O	
Pn40E	Second stage notch filter depth	O	
Pn40F	Second stage second torque command filter frequency	O	
Pn410	Second stage second torque command filter Q value	O	
Pn412	First stage second torque command filter time constant	O	<ul style="list-style-type: none"> <li>• Range of Pn412: 0~65535</li> <li>• Range of Pt412: 1~65535</li> </ul>
Pn415	T-REF filter time constant	O	
Pn416	Torque-related function selection 2	O	
Pn417	Third stage notch filter frequency	O	
Pn418	Third stage notch Q value	O	
Pn419	Third stage notch depth	O	
Pn41A	Fourth stage notch filter frequency	O	
Pn41B	Fourth stage notch Q value	O	
Pn41C	Fourth stage notch depth	O	
Pn41D	Fifth stage notch filter frequency	O	
Pn41E	Fifth stage notch Q value	O	
Pn41F	Fifth stage notch depth	O	
Pn423	Velocity ripple compensation selection	X	Set Pt423 via Thunder.

Parameter	Parameter name	Can be set on controller's human machine interface	Remark
Pn424	Torque limit at main circuit voltage drop	O	
Pn425	Release time for torque limit at main circuit voltage drop	O	<ul style="list-style-type: none"> <li>Range of Pn425: 0~1000</li> <li>Range of Pt425: 0~50000</li> </ul>
Pn426	Torque feedforward average movement time	O	Pt426 only supports 0~500, with the unit of 0.25 ms.
Pn427	Velocity ripple compensation enable velocity	X	Not supported.
Pn456	Sweep torque command amplitude	X	
Pn460	Notch filter adjustment selection 1	X	
Pn480	Velocity limit during force control	O	
Pn481	Polarity detection velocity loop gain	X	Set Pt481 via Thunder.
Pn483	Forward force limit	O	
Pn484	Reverse force limit	O	
Pn485	Polarity detection command velocity	X	Not supported.
Pn486	Polarity detection command acceleration / deceleration time	X	
Pn487	Polarity detection command constant velocity time	X	
Pn488	Polarity detection command waiting time	X	Set Pt488 via Thunder.
Pn48E	Polarity detection range	X	Not supported.
Pn490	Polarity detection load level	X	
Pn495	Polarity detection confirmation torque command	X	
Pn498	Polarity detection allowable error range	X	Set Pt498 via Thunder.
Pn49F	Velocity ripple compensation enable velocity (Linear)	X	Not supported.

## 2.2.6 Parameters for I/O setting – Pn5□□

Table 2.2.6.1

Parameter	Parameter name	Can be set on controller's human machine interface	Remark
Pn502	Rotation detection value	O	
Pn503	Velocity coincidence detection signal output width	O	
Pn506	Brake command - servo OFF delay time	O	
Pn507	Brake command output velocity level	O	
Pn508	Servo OFF - brake command waiting time	O	<ul style="list-style-type: none"> <li>Range of Pn508: 10~100</li> <li>Range of Pt508: 10~65535</li> </ul>
Pn509	Momentary power interruption hold time	O	
Pn50A	Input signal selection 1	X	Set Pt50A via Thunder.
Pn50B	Input signal selection 2	X	Set Pt50B via Thunder.
Pn50E	Output signal selection 1	X	Set Pt50E via Thunder.
Pn50F	Output signal selection 2	X	Set Pt50F via Thunder.
Pn510	Output signal selection 3	X	Set Pt510 via Thunder.
Pn512	Output signal selection 5	X	Set Pt512 via Thunder.
Pn514	Output signal inverse setting	X	Set Pt514 via Thunder.
Pn516	Output signal selection 4	X	Set Pt516 via Thunder.
Pn51B	Input signal selection 7	O	
Pn51E	Position deviation overflow warning level	O	
Pn520	Position deviation overflow alarm level	O	
Pn522	Positioning completion width	O	
Pn524	NEAR signal width	O	
Pn526	Position deviation overflow warning level at servo ON	X	Not supported.
Pn528	Position deviation overflow alarm level at servo ON	X	
Pn529	Velocity limit level at servo ON	X	
Pn52A	Multiplier per one full-closed loop rotation	O	
Pn52B	Overload warning level	O	
Pn52C	Base current derating at motor overload detection	O	
Pn531	Program JOG travel distance	X	Not used in CNC control.
Pn533	Program JOG movement velocity	O	
Pn534	Program JOG acceleration / deceleration time	X	
Pn535	Program JOG waiting time	O	

Parameter	Parameter name	Can be set on controller's human machine interface	Remark
Pn536	Program JOG number of movements	X	
Pn548	Designated alarm number tracking	X	
Pn550	Analog monitor 1 offset voltage	X	Not used in CNC control.
Pn551	Analog monitor 2 offset voltage	X	
Pn552	Analog monitor 1 scale	O	
Pn553	Analog monitor 2 scale	O	
Pn55A	Power consumption monitor unit time	X	
Pn560	Residual vibration detection width	X	Not supported.
Pn561	Overshoot detection level	X	
Pn581	Zero velocity level (Linear movement detection level)	O	
Pn582	Velocity coincidence detection signal output width (Linear)	O	
Pn583	Brake command output velocity level (Linear)	O	
Pn584	Velocity limit level at servo ON (Linear)	X	Not supported.
Pn585	Program JOG movement velocity (Linear)	O	
Pn586	Motor running cooling ratio	X	
Pn587	Polarity detection execution selection for absolute linear encoder	X	Not supported.

**2.2.7 Parameters for application – Pn6□□**

Table 2.2.7.1

Parameter	Parameter name	Can be set on controller's human machine interface	Remark
Pn600	Regenerative resistor capacity	O	
Pn601	Dynamic brake resistor allowable energy consumption	X	Not supported.
Pn603	Regenerative resistance	O	
Pn604	Dynamic brake resistance	X	Not supported.

**2.2.8 Others – Pn8□□**

E series servo drive does not have Pt8□□ series parameters.

### **3. Test Run**

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### 3.1 Test run

There are four methods for users to test whether the motor operates normally, including “Enable input command”, “JOG”, “Ladder diagram”, and “G-code”. The introduction is as follows. For detailed usage description, please refer to SYNTEC CNC controller standard manuals.

◆ Enable input command

>>ES %: Enable the motor

>>ESESES %: Disable the motor

At this time, the MLC mechanical logic alarm —— (R44.0) PLC alarm will appear on controller's human machine interface. Press ESC on the keyboard and enter the following command:

>>ESES %: Enable the motor

>>ESESES %: Disable the motor

◆ JOG

>>M+4: Select the mode “Continuous JOG”

>>Ctrl+X+“+”: Forward direction

Set Pn533 for JOG velocity.

◆ Ladder diagram

Enter the compilation path from the human machine interface (**Electronic control module** → **Diagnostic function** → **PLC status** → **F11 next page** → **Ladder diagram** → **Edit mode**) and edit ladder program.

The path to execute ladder program: **Electronic control module** → **Diagnostic function** → **PLC status** → **F11 next page** → **Ladder diagram** → **Diagnostic mode**.

For detailed function instructions, please refer to SYNTEC application manual “OpenCNC\_PLC Development Tool Operation Manual.”

◆ G-code

Enter the compilation path from the human machine interface (**Home** → **Axial module** → **Program editing**) and write G-code.

The path to save G-code after compilation: **File management** → **Copy file**.

The path to monitor the execution status of G-code program: **Home** → **Axial module** → **Processing monitoring** → **Select processing file**.

The steps to execute G-code are as follows:

>>M+2: Select the mode “Execute automatically”

>>Ctrl+S: Execute G-code (Cycle start)

For related G-code motion instructions, please refer to “General Automation-G Code Instructions.”

G-code point-to-point (P to P) motion example:

```
G01 X15. F20.0      // Move to position X15 at the velocity of 20 control unit  
G04 X0.5            // Pause for 0.5 second  
G01 X5. F10.0        // Move to position X5 at the velocity of 10 control unit  
G04 X0.5            // Pause for 0.5 second  
M30;                // End the program and reverse
```